enclosure 218. A carriage assembly 300, illustrated in phantom under a cover 222, is adapted for reciprocal motion along a carriage bar 224, also shown in phantom. The position of the carriage assembly 300 in a horizontal or carriage scan axis is determined by a carriage positioning mechanism 310 with respect to an encoder strip 320 (see Fig. 1B). A print medium 230 such as paper is positioned along a vertical or media axis by a media axis drive mechanism (not shown). As used herein the media axis is called the X axis denoted as 201, and the carriage scan axis is called the Y axis denoted as 301 (Fig. 1A).

Fig. 1B is a perspective view of the carriage assembly 300, the carriage positioning mechanism 310 and the encoder strip 320. The carriage positioning mechanism 310 includes a carriage position motor 312 which has a shaft 314 which drives a belt 324 which is secured by idler 326 and which is attached to the carriage 300.

The position of the carriage assembly in the scan axis is determined precisely by the encoder strip 320. The encoder strip 320 is secured by a first stanchion 328 on one end and a second stanchion 329 on the other end. An optical reader 366 is disposed on the carriage assembly and provides carriage position signals which are utilized by the invention to achieve optimal registration of images 240 in the manner described below.

Referring to Fig. 2, a carriage 102 is slidably mounted on support bar 172 through a bearing sleeve 171, and includes four slots 121, 123, 125, 127 for removably receiving four inkjet print cartridges. From right to left in the carriage slots are respectively mounted a black ink print cartridge 120, a magenta ink print cartridge 122, a cyan ink print cartridge 124 and a yellow ink print cartridge 126.

The enlarged perspective view of Fig. 3 shows an exemplary refillable print cartridge 140

with two columns of nozzles 142, a handle 144, and an ink inlet housing 146 having a receptacle 148 for receiving an ink supply coupler (not shown).

The invention has been successfully demonstrated with four 600 dpi print cartridges of the type shown in Figs. 2 and 3. In a currently preferred embodiment the black ink cartridge has a 600 dpi nozzle pitch resolution and a printer incorporates the invention to print monochrome images with 600 dpi sized drops on an asymmetrical 1200 X 600 pixel grid.

A modified carriage (not shown) may carry a removably mounted black ink cartridge similar to 120, and a tri-compartment ink cartridge (not shown) which has separate ink reservoirs for cyan, magenta and yellow ink, respectively. Color images may be printed in a 600 x 600 dpi default mode (see step 201 in Fig. 4A).

The embodiments described herein employ a new technique which allows an inkjet printer system to print A x B resolution monochrome bitmaps which A=B in a system where A dpi is addressable in the carriage scan axis and B/2 dpi is addressable in the media advance axis. Thus, the present system and methods may be used with asymmetrical sub-pixels that are only half as wide in the carriage scan direction as they are in the media advance direction.

The embodiments herein enable an inkjet printer system to utilize only the even width lines while preserving both edges without losing its ability to render one-pixel width lines. This enables it to keep the smallest detail in a bitmap image.

The present systems and methods may be accomplished in the steps illustrated in Figs 4 and 5. As shown in Fig. 5, the present systems and methods may be accomplished in three sequential steps 200, 202, 204. First, as shown in Fig. 4A the A x B bitmap is processed by a narrowing process step 200 which in the exemplary embodiment comprises detecting the vertical

edges (50), and then shifting one pixel distance to the left each right edge pixel which is not also a left edge pixel (52).

Referring again to Figure 5, the next step is a logical combining 202 of rows of the pixel grid. In taking an A x A bitmap and converting to an A x A/2 bitmap for printing, a problem faced was that for certain images some horizontal rows would be lost and not shown on the final A x A/2 image. To solve this problem, several rows of data were taken together and a logical operation was performed on the rows such that no horizontal row would be removed while following through the process as shown and described in relation to Figures 4B, 6 and 7. The logical combination of rows 202 ensures that the resulting row from the operation will have information from at least one of the rows involved in the operation and that no information will be lost. The actual dot location is in the middle between nonpreserved and preserved rows (see Fig. 7).

The object of the logical combination step 202 is to downscale the raster (step 54) of the image (not reduce the ink) in the vertical axis without losing information. It is necessary with the present systems and methods to downscale in order to be able to work in an asymmetric writing system (where A /= B). Accordingly, the goals of this stage are different than other systems because the present embodiments are preparing a raster to be printed on an asymmetric system. Because the goals are different, the procedure also, as expected, will also be different.

In other systems two rows were worked with and processed at the same time.

In the present embodiments, there is no need to deplete in the vertical axis, because the system is only B=A/2 addressable. Accordingly, it is not possible to put double ink drops on the same pixel. With the present systems the goal for the vertical axis is then opposite of the other

systems because with the present system, the logical combination step 202 serves to add pixels instead of deplete pixels. The logic combination step 202, in current design shown in detail in Fig. 4B works with three rows at the same time of a 1200 x 1200 bitmap image (see step 49) instead of two rows like some other systems have and currently do.

Referring to Fig. 6, a pixel in a non-preserved row 80 is ignored (step 61) when at least one vertical adjacent pixel is "on" (see comparison tables 82). Alternatively a pixel in a non-preserved row 80 is "preserved" (see step 62) when no vertical adjacent pixel is "on" (see comparison tables 86).

The present system identifies isolated objects which would be lost in a media advance axis direction, directly a result of having a lower media advance axis resolution which eliminates odd numbered pixel rows in the 1220 x 1200 bit map (see Fig. 7). Then the present system acts to save the image and moves these isolated objects one row upward such that the isolated object will not be lost.

The final step as shown in Fig. 4C is a horizontal depletion step 204. This horizontal depletion step 204 is the same as some horizontal depletion methods described earlier except that the depletion is applied as a final step after the three row's logical operation step 202, and only in the horizontal direction, that is, only in the carriage scan axis and not in the media advance axis. The horizontal depletion 204 saves each vertical left edge pixel (step 70), depletes alternate interior pixels (step 72) and thus preserves both the right and left vertical edges 74, 76 and also the horizontal edges (see Fig. 8).

By using this method and steps as described, the present embodiments are able to assume and store a 1200 x 1200 image in the rendering stage and produced a 1200 x 600 dpi image for the writing stage without losing any resolution for one-pixel width lines. Of course, the 1200 dpi is in the scan axis and the 600 dpi is in the paper axis.